



Designation: C1576 – 05 (Reapproved 2017)

Standard Test Method for Determination of Slow Crack Growth Parameters of Advanced Ceramics by Constant Stress Flexural Testing (Stress Rupture) at Ambient Temperature¹

This standard is issued under the fixed designation C1576; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This standard test method covers the determination of slow crack growth (SCG) parameters of advanced ceramics by using constant stress flexural testing in which time to failure of flexure test specimens is determined in *four-point* flexure as a function of constant applied stress in a given environment at ambient temperature. In addition, test specimen fabrication methods, test stress levels, data collection and analysis, and reporting procedures are addressed. The decrease in time to failure with increasing applied stress in a specified environment is the basis of this test method that enables the evaluation of slow crack growth parameters of a material. The preferred analysis in the present method is based on a power law relationship between crack velocity and applied stress intensity; alternative analysis approaches are also discussed for situations where the power law relationship is not applicable.

NOTE 1—The test method in this standard is frequently referred to as “static *fatigue*” or stress-rupture testing (1-3)² in which the term “*fatigue*” is used interchangeably with the term “slow crack growth.” To avoid possible confusion with the “*fatigue*” phenomenon of a material that occurs exclusively under cyclic loading, as defined in Terminology E1823, this test method uses the term “constant stress testing” rather than “static *fatigue*” testing.

1.2 This test method applies primarily to monolithic advanced ceramics that are macroscopically homogeneous and isotropic. This test method may also be applied to certain whisker- or particle-reinforced ceramics as well as certain discontinuous fiber-reinforced composite ceramics that exhibit macroscopically homogeneous behavior. Generally, continuous fiber ceramic composites do not exhibit macroscopically isotropic, homogeneous, continuous behavior, and the application of this test method to these materials is not recommended.

¹ This practice is under the jurisdiction of ASTM Committee C28 on Advanced Ceramics and is the direct responsibility of Subcommittee C28.01 on Mechanical Properties and Performance.

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² The boldface numbers in parentheses refer to a list of references at the end of this standard.

1.3 This test method is intended for use with various test environments such as air, other gaseous environments, and liquids.

1.4 The values stated in SI units are to be regarded as the standard and in accordance with IEEE/ASTM SI 10 Standard.

1.5 *This test method may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety concerns associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:³

- C1145 Terminology of Advanced Ceramics
- C1161 Test Method for Flexural Strength of Advanced Ceramics at Ambient Temperature
- C1322 Practice for Fractography and Characterization of Fracture Origins in Advanced Ceramics
- C1368 Test Method for Determination of Slow Crack Growth Parameters of Advanced Ceramics by Constant Stress-Rate Strength Testing at Ambient Temperature
- C1465 Test Method for Determination of Slow Crack Growth Parameters of Advanced Ceramics by Constant Stress-Rate Flexural Testing at Elevated Temperatures
- E4 Practices for Force Verification of Testing Machines
- E6 Terminology Relating to Methods of Mechanical Testing
- E112 Test Methods for Determining Average Grain Size
- E337 Test Method for Measuring Humidity with a Psychrometer (the Measurement of Wet- and Dry-Bulb Temperatures)
- E399 Test Method for Linear-Elastic Plane-Strain Fracture Toughness K_{Ic} of Metallic Materials
- E1823 Terminology Relating to Fatigue and Fracture Testing

3. Terminology

3.1 Definitions:

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.